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(58) Field of search
C7F

(54) Forming coloured coatings by ion plating

(57) A metal is coated with a thin coating of a hard metal compound by an ion-plating process, and a further coating of an elemental metal or an alloy is formed by the ion-plating process over its whole area or in a desired pattern.

The hard metal compound may be chromium nitride, TiN or TiC.

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SPECIFICATION

A method of processing a metal surface

Description

This invention relates to a method of processing a metal surface, in which a surface of a metal material is coated over its whole area or in a desired pattern with a durable, beautiful and lustrous metal or noble metal.

A conventional metal product having on its surface a plating of noble metal, such as gold, has shortcommings in that the noble metal plating tends to come off and leave unsightly specks of base material showing through especially in areas of frequent use. Furthermore, lustrous patterns provided on a metal surface are generally poor in durability and tend to come off with rubbing.

The object of the invention is to provide a method of processing a metal surface in which a surface of a metal material is coated over its whole area or in a desired pattern with a durable, beautiful and lustrous metal or noble metal.

According to the present invention there is provided a method of processing a metal surface, in which the surface of the metal is coated with a thin coating of a hard mteal compound by an ion-plating process, which thin coating is provided with a further coating of an elemental metal or an alloy by an ion-plating process over its whole area or in a desired pattern.

The hard metal compound is preferably selected from chromium nitride, titanium nitride and titanium carbide.

As the elemental metal, there may be used gold, silver, platinum, copper, zinc, palladium, chromium, rhodium, nickel, germanium, cobalt, zirconium, tungsten, tantalum, noibium, manganese, molybdenum, tin and iron. The alloy for the further coating may be selected from alloys of gold, silver, platinum, copper, palladium, chromium, rhodium, indium, nickel, germanium, cobalt, zirconium, tungsten, tantalum, niobium, mangangese, molybdenum, tin, iron, zinc or aluminium.

The invention will be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a sectional view of a finished product prepared by the method according to the invention;

Figure 2 is a sectional view of the product of Figure 1 after use for some period of time; and

Figure 3 is a perspective view of another product with patterned coating.

In the drawings, reference numeral 1 represents a cap crown formed of a zinc alloy, for example, as a metal material and applied to a cured tooth. A surface of the crown 1 is coated with a prime coating 2 of titanium nitride as a hard metal compound in a thickness of 3μ by means of an ion-plating process, which may be carried out under the following conditions. 100 ml/min. of an argon gas is introduced and a bombard treatment is carried out under a condition of a gas pressure of 0.07 Torr, a voltage of 590 V and a current of 2.2 A for 30 minutes. Then, 90 ml/min. of a nitrogen gas is introduced to provide a gas pressure of $9 \times 10^{-5} \sim 1.3 \times 10^{-4}$ Torr and a titanium metal is evaporated for 40 minutes under a condition of an EB voltage and current of 6.5 KV and 590 mA, as well as an ionizing volktage and current of 40 V, 65~75 A and a bias of 350~450 V, 4.5~5.0 A. Thereafter, the gas pressure is adjusted to 1×10^{-5} Torr, and the product is removed after cooling for 40 minutes.

Thus, the surface of the crown 1 is coated with the prime coating of golden colour, which has a surface hardness of 1720 HV and a high corrosion-resistance. However, the golden colour is somehwat inferior to that of a true gold.

The surface of the prime thin coating 2 is then coated with a secondary thin coating 3 of gold in a thickness of 5-10μ by means of the ion-plating process, which may be carried out under usual conditions for ion-plating an elemental metal.

The crown 1 thus processed has a secondary thin coating 3 of gold, which shows the true gold colour. However, the gold as the secondary coating 3 is very soft and weak, so that frequent use of the crowned tooth may cause the coating 3 to wear away, as shown in Figure 2. Under the secondary coating 3, there exists the prime coating 2 of titanium nitride, which shows a golden colour similar to true gold, thereby to prevent specks from appearing after the secondary coating 3 has worn away. Usually, the cap crown 1 of such type is used for a back tooth, so that the apparent golden colour may be kept for a long period of time of use.

As shown in Figure 3, at first a whole surface of an accessory item 4, such as a tie-pin, cuffs or a brooch, is coated with a thin coating 5 of black titanium carbide by the ion-plating process under the same conditions as for the crown 1. Then, the thin coating 5 of titanium carbide is masked with a suitable pattern or a name, on which is coated a secondary thin coating 6 of a platinum by the ion-plating process. Thereafter, the mask is removed to leave the patterned coating.

The prime coating 5 of titanium carbide has a very high hardness and so is resistant to damage as is the coating 6 of platinum, so that a durable and luxurious accessory item may be produced.

Alternatively, the surface of the metal material may be coated with a thin coating of chromium nitride by the ion-plating process, and then further coated with silver alloy by the ion-plating process to form a durable and luxurious product which does not suffer from the occurrence of specks, in the same way as the coating combination of titanium nitride when gold described above.

Similarly, the prime thin coating 5 of hard metal compound, such as chromium nitride, titanium nitride or titanium carbide, which has been coated on the metal material by the ion-plating process, may be coated also by the ion-plating process with a secondary thin coating 6 of an elemental metal or an alloy capable of dry-plating, such as gold, silver, platinum, copper, zinc, palladium, chromium, rhodium, indium, nickel, germanium, cobalt, zirconium, tungsten, tantalum, niobium, manganese,